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DEVELOPMENT ALTERNATIVES

A Nation Under Smog: "As iconic landmarks disappear, we examine the policies and citizen science needed to move from privileged protection to shared solutions and clean air for all"

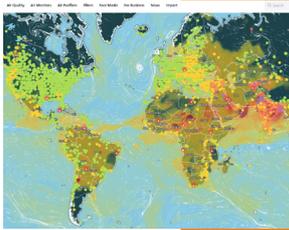


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Trans-boundary Air Pollution – The Untold Story

In this editorial, Dr Soumen Maity examines the serious health risks posed by transboundary air pollution, particularly in South Asia, where it claims millions of lives each year. He emphasises that 99% of the global population is exposed to unsafe air, highlighting the need for coordinated regional initiatives. Dr Maity argues that effective policies, technological solutions, and international collaboration are essential to significantly reduce pollution and improve public health.

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Equity for Clean Air: Bridging Technology and Justice

India has been facing stark air pollution inequities, with low-income communities disproportionately affected despite contributing less to emissions. In this article, Hrishita Gupta advocates for a dual approach—reducing pollution and democratising access to clean technologies—that is essential for bridging this gap. She emphasises that ensuring affordable clean air solutions can enhance health and well-being, making clean air a fundamental right for all.

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Breathing a Privilege: Catalysing Policy Resilience in India's Clean Air Transition

India's air quality crisis has transformed clean air into a privilege, leading to an estimated 1.72 to 2 million premature deaths annually and an economic toll equivalent to 1.36% of the GDP. Gyanesh Gupta, in this article, contends that while initiatives like the National Clean Air Programme show political commitment, significant gaps in institutional capacity and enforcement hinder meaningful progress, especially for low-income workers exposed to pollution. He emphasises that comprehensive reforms and coordinated action are essential to achieving sustainable improvements in air quality.

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Bundelkhand Diary



Partnerships for Combating Air Pollution and Ensuring Mineral Security in Bundelkhand

In this article, Debojyoti Basuroy highlights how Bundelkhand is evolving into a model of regenerative development, as showcased during a visit by a team from the University of Queensland. Collaborating with the Development Alternatives Group, they aim to enhance mineral security through sustainable practices, combining local insights with global expertise to foster innovation and improve livelihoods in climate-stressed regions.

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Ground story



Steps to Clean Air Start from Home: Story of a Home Composter

In this article, Tulsi Yadav explores the Home Composter, an innovative solution for responsible household waste management that transforms organic waste into compost. She says this concept has gained popularity throughout India, promoting environmental awareness, reducing reliance on landfills, and empowering communities. The Home Composter exemplifies how simple actions taken at home can lead to significant improvements in air quality and sustainability.

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Ground story



Citizen Science for Clean Air: Communities Taking Data into Their Own Hands

In Patna, air pollution poses a severe health risk, prompting a citizen science initiative that empowers residents to monitor air quality. In this article, Nilufer Sajjad writes about volunteers like Sabhyata who use low-cost sensors to collect real-time data, enhancing community understanding of pollution sources and fostering local engagement in tackling environmental challenges.

The views expressed in the articles in this newsletter are those of the authors and not necessarily those of Development Alternatives.

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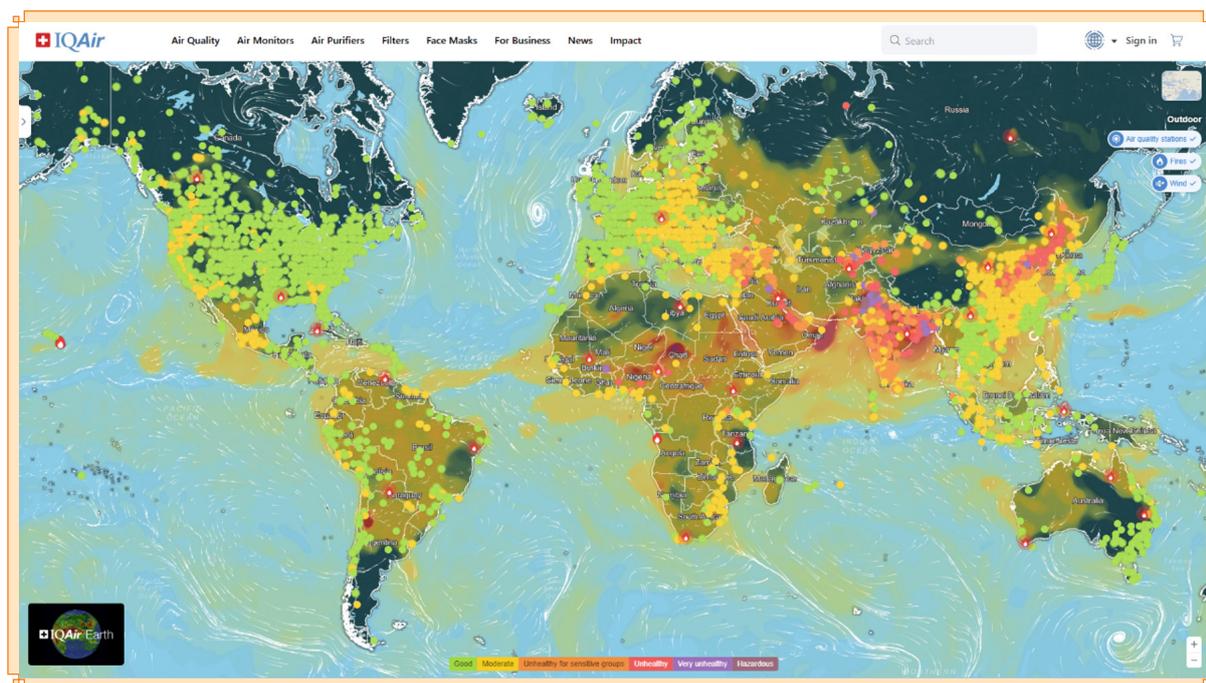
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Trans-boundary Air Pollution – The Untold Story



Status of polluted cities as on 12 November 2025 (IQ Air)

In 2024*, around 8.1 million people died globally due to air pollution. After cardiovascular disease, exposure to toxic air is the second leading cause of death across all age groups. It acts as a silent killer, contributing to heart disease, stroke, lung cancer, diabetes, and chronic obstructive pulmonary disease (COPD) (**State of Global Health Report, 2024**). Poor air quality is a significant global issue. The World Health Organisation (WHO) estimates that 99% of the world's population lives in areas with air quality below the recommended limits.

The situation in the world's most populous country, India, is quite alarming. A new study published in 2025 found that long-term exposure to air pollution results in an additional 1.5 million deaths per year in India, compared to what might occur if India met the WHO's recommendations for safe air quality. The situation is particularly serious for infants. According to the State of Global Health Report, 2024, approximately 464 children under the age of five die every day in India because of toxic air quality. It is important to note that the right to breathe clean air is recognised as a fundamental right in India under Article 21 of the Constitution,

which guarantees the right to life. As demonstrated in the map, Asia, led by India, is among the regions most severely affected by air pollution. While Delhi often makes headlines each year, air quality is an issue throughout India and beyond its boundaries. This is evident on the air pollution map of India, which shows that many cities across the country are highly polluted, especially during the winter season. In the National Capital Region, the major sources of air pollution include transportation, road dust, power plants, construction, diesel generators, vehicles, crop burning, household emissions, and various industries. The problem is even exacerbated by the city's existing policies. For example, during times of high air pollution, sweeping roads with brooms in the early morning creates more dust and worsens air quality. Instead, using vacuum suction to clean the roads would be a more effective solution. The collected dust can be repurposed for beneficial uses, thanks to technology developed by TARA.

The Indo-Gangetic plains in India serve as a significant hub of air pollution. The major sources of this pollution include industrial activities, thermal power plants, brick kilns, cookstoves, open fires, and transportation.

* As per State of Global Health Report, 2024

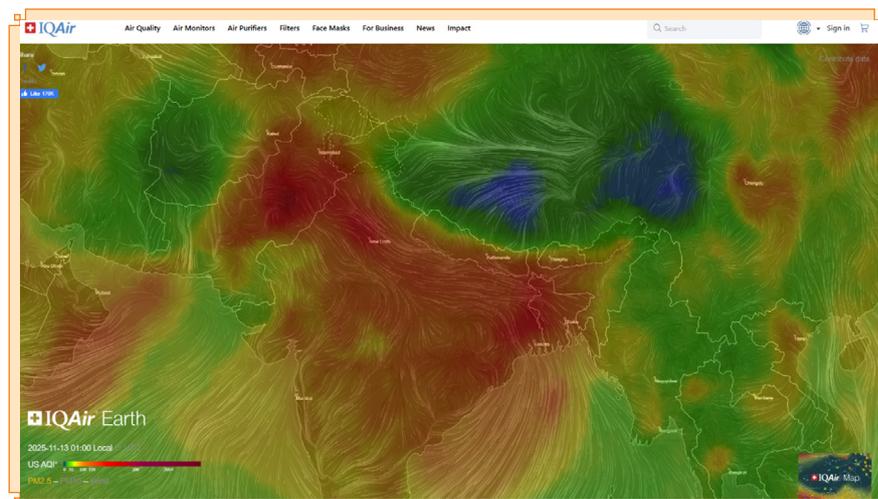
However, the issue of transboundary air pollution is often overlooked in the region. Pollution from neighbouring countries such as Afghanistan, Pakistan, Bangladesh, and India flows across each other, aggravated by the air flow patterns, as illustrated in air quality maps. Pakistan, especially areas like Lahore, Bahawalpur, and Multan, is a major source of pollution, with contaminated air coming from various directions. As the air flows from west to east, these pollutants also move through India, increasing pollution levels in the Indo-Gangetic plains and the Terai regions of Nepal and Bhutan. Additionally, polluted air flows into Bangladesh and vice versa. The distribution of these pollutants is influenced by airflow patterns, which can vary throughout the day and across different seasons.

Transboundary air pollution refers to air pollution that does not stop at national boundaries but continues to cross them. Both countries and regions are affected by the movement of this contaminated air. Industrial and household activities release fine particulate matter and other harmful gases into the atmosphere, where they can remain suspended and travel long distances. Research has shown that high emissions of particulate matter and black carbon are significant contributors to the melting of glaciers in the Himalayas, aggravated by transboundary pollution.

A WHO report on the health risks of particulate matter from long-range transboundary air

pollution confirms that particulate matter generated by various human activities can travel long distances in the atmosphere. This pollution leads to a wide range of diseases and significantly reduces life expectancy in many populations across affected regions.

All governments in the affected regions of South East Asia recognise their regional responsibility to address air pollution and are taking steps to reduce it. However, there is a need for coordinated efforts among all countries. Intergovernmental organisations, such as ICIMOD, UNDP, ADB, and the World Bank, could establish a transboundary air pollution agenda. This agenda would focus on raising awareness, implementing technological solutions, developing policies and cooperation strategies, sharing best practices, and applying successful approaches in respective areas. These efforts will not only save human lives but also lower healthcare costs by reducing hospitalisation rates. Furthermore, it will contribute significantly to global efforts to reduce carbon and other aerosol emissions, benefiting both the environment and the public health. Most importantly, gathering data at regional, national, and local levels is essential before effective mitigation actions and strategies can be formulated. □



Air flow movement as on 13 November 2025 (IQ Air)

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Equity for Clean Air: Bridging Technology and Justice



Technology meets Justice to bridge the divide

Air pollution in India has never been an equal burden. While high-income households contribute significantly to emissions through private vehicles, construction, diesel generators, and energy-intensive lifestyles, they also have the means of protecting themselves from their impacts. These households can afford air purifiers, certified masks, electric vehicles, clean cookstoves, and homes that are dust-controlled and enclosed. Even when their health is affected by pollution, their access to quality healthcare helps mitigate the consequences.

In contrast, low-income and marginalised communities face the dual injustice of **contributing less while being more exposed to the negative effects**. These communities cannot afford high-efficiency vehicles or protective equipment. Many individuals work on construction sites without proper safety gear, live in open or poorly ventilated homes, and reside closer to pollution sources such as industrial clusters, waste burning sites, and congested traffic corridors. Their inability to purchase purifiers, masks, or clean energy technologies only **deepens the inequity**. Most crucially, limited access to healthcare means

illnesses result in untreated illnesses, which reduces life expectancy and lowers overall well-being. This systemic imbalance raises an important question: **Can this gap be bridged? Yes, it can!**

A Dual Approach: Reduce Pollution + Make Clean Technologies Equitable

Equity in clean air requires a two-pronged approach: reducing pollution at the source and ensuring that access to protective measures and clean living resources is accessible to all.

Reducing pollution levels at scale: Achieving cleaner air is impossible without structural fixes. This includes implementing stringent industrial emission norms, better construction dust management, cleaner fuel transitions, waste management solutions to eliminate burning, and scaling renewable energy. When pollution levels decrease across the board, the disparities in exposure will naturally lessen.

Affordable, accessible clean technologies: A major pathway to equity lies in democratising clean technologies; affordable and accessible

clean technologies are crucial for equity. This could include the following:

- Affordable clean cookstoves and alternative fuel
- Subsidised masks and community-level air filters
- Low-cost, durable housing improvements that reduce dust intrusion
- Affordable, well-connected electric vehicle public transport options
- Decentralised renewable energy systems for households and livelihoods

Some emerging pathways to achieving air equity can be visualised as follows:

1. **Reliable, affordable public transport:** A strong public transit system with electric buses, clean shared mobility, and last-mile connectivity reduces private vehicle dependence and lowers both emissions and household expenses. This is one of the most powerful equalisers because it supports mobility, economic opportunities, and public health simultaneously.
2. **Renewable energy transitions:** Renewable energy sources, both centralised (solar parks, wind) and decentralised (rooftop solar, community energy hubs, solar micro-grids), help to reduce local pollution from diesel generators, solid fuels, and coal-heavy grids. Decentralised renewable energy, in particular, benefits rural and peri-urban communities by improving energy access and providing cleaner indoor environments.
3. **Livelihood-centred clean technologies:** Clean air cannot be achieved without transforming the technologies that shape livelihoods:
 - More efficient brick-making processes
 - Low-emission machinery for small-scale industries
 - Waste-to-resource solutions to prevent burning

Development Alternatives Group has been focusing on energy transitions, cleaner brick-making processes, and waste management to realise the above.

Air quality equity is not only a technological challenge but also a fundamentally social issue.

Gender- Women often face higher indoor air pollution exposure due to cooking patterns; clean energy transitions are essential for their health.

Geographical inequity: Rural and peri-urban regions are often ignored in air quality action plans, despite high exposure from biomass use and poor waste management.

Information equity: Access to real-time air quality data and awareness helps communities demand action and protect themselves.

Policy equity: Policies must prioritise pollution hotspots and vulnerable populations, not just high-profile urban centres.

Ultimately, clean air is a **fundamental right under Article 21 of the Indian Constitution**. However, rights must be made meaningful through deliberate actions, inclusive policies, and accessible technologies to prevent this inequity from becoming the new normal. To bridge the clean air divide, we require systems that reduce pollution for everyone while empowering marginalised communities with affordable, context-appropriate solutions. Only then can we move towards a future where the air we breathe does not reflect our income, our location, or our social identity but our shared humanity. □

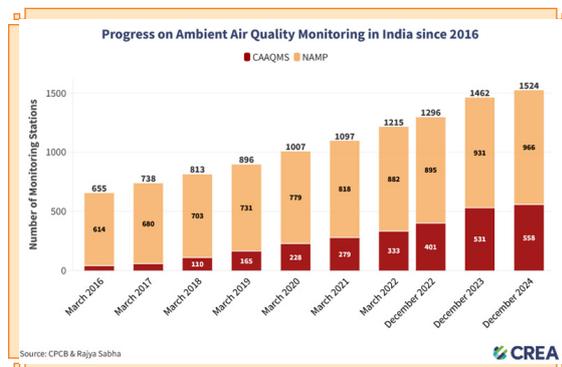
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Breathing a Privilege: Catalysing Policy Resilience in India's Clean Air Transition

Clean air in India has ceased to be a common public good. For millions of people, breathing safely has become an invisible burden, turning clean air itself into a privilege that disproportionately affects all segments of society. This environmental failure is, fundamentally, a public health and economic crisis. Recent analyses show that air pollution is responsible for approximately 1.72 million to 2 million premature deaths annually in India [1], exacting an economic toll equivalent to 1.36% of the national GDP, or roughly USD 36.8 billion in 2019 [2]. When air quality index (AQI) readings surge into the 'Severe' category, reaching alarming figures of nearly 590 [3], authorities resort to emergency measures, such as the Graded Response Action Plan (GRAP) [4].

Large-scale initiatives, such as the National Clean Air Programme (NCAP), which aims to achieve a 40% reduction in PM10 concentrations by 2025-26, demonstrate a political commitment; the programme's success ultimately depends on institutional alignment and enforceable delivery mechanisms. The strategy extends far beyond this single programme; the main challenge lies in the institutional chasm between policy intent and rigorous, sustained implementation. This disparity ensures that the right to breathe clean air becomes a precarious, seasonal privilege rather than a fundamental entitlement [5].

Concurrently, parallel improvements across key sectors signal incremental progress. Strengthening vehicular emission standards, promot-



Progress on ambient air quality monitoring in India since 2016

ing the adoption of electric vehicles (EVs), and expanding access to cleaner cooking fuels, such as LPG, under the PMUY and PAHAL programmes, have contributed to measurable reductions in household and transport-related pollutants. However, despite the national transition to Bharat Stage-VI (BS-VI) standards, some crucial regulatory features were initially weakened: for instance, Real-Driving Emissions (RDE) testing, which is critical for verifying real-world vehicular compliance, was delayed until 2023 for both light- and heavy-duty vehicles. This created an immediate gap between the standards set and those actually enforced. Yet, these improvements only partially mitigate the broader emissions landscape and fall short of maintaining air quality within acceptable thresholds, underscoring the need for more comprehensive structural reforms.

Policy-to-Ground: Where It Breaks Down

The central challenge in translating policy ambition into on-ground outcomes lies not in the absence of strong national frameworks, but in the need for sustained capacity enhancement across executing institutions. State pollution control boards (SPCBs), as the nodal agencies for compliance, operate under significant resource constraints. Official data indicates that nearly half (47%) of sanctioned posts across SPCBs remained vacant as of April 2025 [6]. Strengthening institutional capacities—human, technical, and financial—would support continuous monitoring, timely analysis, and effective enforcement of mandated stan-



Thick smog blankets the area near the Yamuna River at Kalindi Kunj, in New Delhi.

Photo Credit: ANI

dards, including those governing industrial emissions [7]. For instance, achieving the targeted emission reductions for thermal power plants requires an estimated cumulative investment of USD 35 billion in retrofitting technology. This critical mandate necessitates fortified fiscal and technical support for monitoring agencies to ensure reliable enforcement. Furthermore, the mandate of SPCBs has expanded substantially over the past two decades, now covering hazardous, bio-medical, solid, and construction waste, as well as 11 additional laws since 2000. Given this broadened scope, a structured approach to capacity augmentation and prioritisation can help ensure that inspection frequencies, reporting processes, and response mechanisms remain aligned with emerging environmental management needs.

The consequences of these implementation gaps pose an immediate, non-negotiable health liability for citizens. Low-income workers, particularly those employed near industrial or construction sites, are among the most exposed to air quality risks. These exposures contribute to an estimated loss of 1.3 billion working days annually, primarily due to absenteeism and decreased productivity [8]. This, in turn, influences sectoral competitiveness and regional economic outcomes, highlighting the importance of strengthening regulatory systems to support human capital and enhance resilience.

A further area for institutional strengthening relates to airshed governance. Several pollution sources, such as the burning of agricultural residues, operate at regional scales

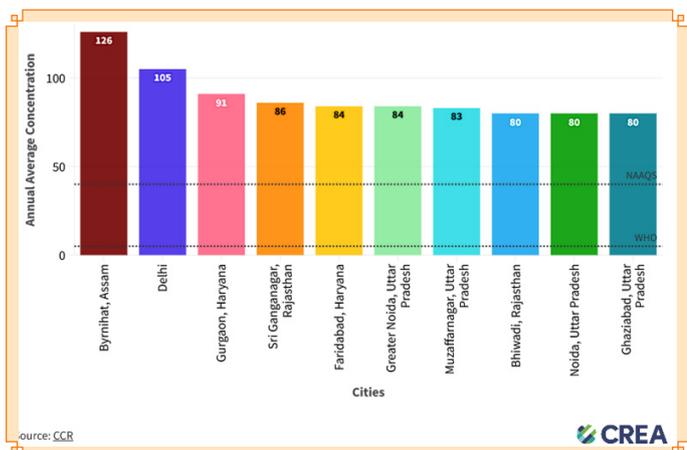
and exhibit regional behaviour and impacts [9]. While regulatory authority typically lies within specific jurisdictional boundaries, complementary mechanisms for coordinated interstate action can enhance the effectiveness of air quality management. The Indo-Gangetic Plain, for instance, requires sustained, unified inter-state coordination, a measure often complicated by conflicts stemming from divergent agricultural and environmental policy frameworks [10]. Economic losses from air pollution vary more than threefold across states, with relatively higher impacts in states such as Uttar Pradesh, Bihar, Madhya Pradesh, and Chhattisgarh [11]. This suggests the value of differentiated state-specific strategies supported by consistent central coordination. Addressing air pollution as a shared economic and environmental externality can therefore help reduce regional disparities and support more equitable outcomes [12].

Catalysing Resilience Through Institutional Action

Translating policy ambition into measurable success requires strengthening performance-driven mechanisms, technological augmentation, and integrated policy architecture.

First, scaling market-based instruments offers a high-impact, low-cost path to industrial abatement. The pilot 'Emissions Trading Scheme' (ETS) in Surat, Gujarat, successfully reduced industrial particulate matter emissions by 20–30% among participating industries while simultaneously lowering their compliance costs by 11% [13]. This success stemmed from measurable caps, transparent monitoring, and economic incentives that aligned industrial behaviour with regulatory goals. With demonstrated effectiveness and favourable cost–benefit ratios, expanding ETS to additional sectors and regions presents a strong opportunity for consideration [14].

Second, digital governance can play an important role in addressing enforcement gaps. To compensate for the SPCB staffing shortage, Geo-spatial Artificial Intelligence (GeoAI), integrated with satellite monitoring and low-cost sensor networks, offers the potential to provide real-time, high-precision intelligence



Top 10 most polluted cities in India by PM2.5 concentration in 2024

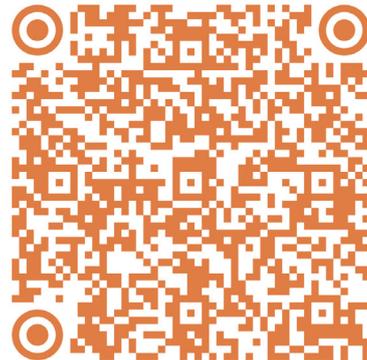
[15]. This technology enables policymakers to transition from reactive responses to proactive strategies, enabling them to anticipate pollution peaks and implement targeted interventions such as temporary traffic restrictions. Additionally, real-time remote monitoring also supports regulators to continuously track emissions from industrial units, thereby improving compliance and reducing opportunities for evasion. Furthermore, mandatory public disclosure of facility compliance status and enforcement actions could help strengthen accountability and increase public participation [16].

Finally, institutionalising Airshed Management Authorities (AMAs), similar to the existing Commission for Air Quality Management (CAQM) but scaled to regional airshed boundaries, may offer a constructive pathway towards sustained success [3]. By creating statutory, cross-state governance structures, AMAs would effectively overcome CAQM's limited geographical scope by aligning administrative authority with the actual movement of pollutants. These statutory bodies could guide unified policies that link sustainable urban planning, accelerate investments in public transportation to manage rapid urbanisation, and integrate agricultural policies to create profitable value chains for the monetisation of crop residues. By aligning farmer incentives with residue management, such as through buy-back guarantees or biomass market development, there is potential to reduce stubble burning, as secondary users currently offer up to USD 22 per tonne of straw. Leveraging performance-based fiscal mechanisms, such as the USD 1.7 billion

allocated via the 15th Finance Commission, contingent upon city-specific pollution reduction [17], can provide an enabling incentive for state-level action towards health-aligned improvements.

India has developed effective policy frameworks and successful pilot solutions. The task ahead lies in translating this policy momentum into decentralised, resilient, and non-fragmented implementation. By prioritising continuous, technology-aided compliance over reactive emergency management, India can continue to strengthen its efforts to safeguard clean air for all citizens. Embedding long-term financing, transparent reporting, and systematic capacity enhancement across regulatory institutions will further support durable and equitable outcomes. □

Scan the QR code below for all references in this article.



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Partnerships for Combating Air Pollution and Ensuring Mineral Security in Bundelkhand



DA and University of Queensland team in Orchcha

The rugged landscape of Bundelkhand, known for its scarcity and resilience, is steadily transforming into a living laboratory of regenerative development. During their visit to the TARAGram Campus in Orchha, the team from the University of Queensland's (UQ) Sustainable Minerals Institute, led by Professor Daniel Franks and PhD researcher Shrey Varshney, witnessed this transformation firsthand. What they saw was not merely technology or enterprises; instead, they saw a region actively shaping its own mineral-secure future through innovation, community leadership, and decades of grassroots learning by the Development Alternatives Group.

From green building materials to clean technologies that reduce dust and emissions, Bundelkhand has demonstrated how sustainable resource use can strengthen livelihoods while improving air quality in some of India's most climate-stressed districts. These efforts showed that mineral value chains, when re-designed responsibly, can reduce pollution, enhance health outcomes, and build more breathable, resilient settlements.

This grounded experience led to a shared vision: a partnership founded on co-creation, where global research meets local knowledge. The emerging memorandum of understanding (MoU) between UQ and DA aligns their efforts towards mineral security, ore-sand solutions, regenerative pathways, collaborations under the UNESCO Chair, capacity building, policy influence, and research initiatives.

By combining Bundelkhand's lived experiences with UQ's global expertise, this partnership aims to create a lasting, scalable impact, positioning Orchha as a global hub for innovation in clean air and sustainable mineral futures. □



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Steps to Clean Air Starts from Home: Story of a Home Composter

A simple technology helping air we breathe



Waste burning: a stark visual of pollution worsening our atmosphere.

Source: For Air Pollution, Trash Is a Burning Problem | Climate Central, n.d.

A simple idea, born out of the need to manage household waste more responsibly, has quietly grown into a wider movement for change. The ‘Home Composter’ began as a practical solution to turn everyday organic waste into useful compost, reducing the burden of open waste disposal. Today, it is being embraced by households across India—showing how a small innovation can inspire environmental responsibility, improve local waste practices, and empower communities through accessible, sustainable technology.

The concept is straightforward: managing waste at home to reduce the need to transport it to landfills or burn it in the open spaces. This not only decreases air pollution but also contributes to cleaner environments and healthier living areas. The idea is grounded in Vigyan Ashram’s approach of developing low-cost, locally workable solutions for everyday challenges.

The TAP-RISE platform played a crucial role in transforming a simple yet powerful idea into a large-scale implementation. Green International, a partner organisation, took the lead in refining the design and preparing it for market

readiness. TAP-RISE extended focused support at every step, from product registration and packaging to listing on e-commerce platforms and connecting with technical experts for design improvements.

The journey from prototype to market-ready technology (Technology Readiness Level 8) was challenging. What made the difference was the ongoing technical support and the market connections offered through the TAP-RISE ecosystem. Once the Home Composter was listed on the ONDC platform, it reached both urban and rural households, making sustainable waste management accessible to a wide range of users. Within a year, the results were remarkable. The technology achieved pan-India outreach across 14 states, achieving a tenfold increase in sales and a 9.5-fold rise in revenue. These numbers reflect not only market success but also a shift in public awareness, with more households now taking active steps to manage waste responsibly.

On the ground, the story is about small actions leading to visible change. Families using the composter have observed cleaner surroundings, reduced odour, and less dependence on municipi-

pal waste systems. For many, the composter has become a symbol of self-reliance and environmental consciousness. The technology's simplicity, no complex machinery, no heavy infrastructure, has helped it reach homes in both cities and smaller towns.

By turning household waste into compost, the Home Composter helps reduce open burning and the burden on landfills, both of which are significant contributors to air pollution. It also generates a sense of ownership among users toward their environment. The story behind this innovation reminds us that addressing something as complex as air quality can begin with simple actions taken at home.

From a small idea rooted in the need for better household waste management to a product now available across India, the Home



Home composter as a solution to the household waste

Composter stands as an example of how local innovation, when supported by the right ecosystem, can create national-level impact—helping every household take one step towards cleaner air. □

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Citizen Science for Clean Air: Communities Taking Data into their Own Hands

Across India, air pollution has become an urgent and invisible crisis, contributing to a growing public health emergency as city after city ranks among the world's most polluted. A 2021 Lancet study [1] estimated that 1.67 million deaths in India in 2019 were linked to air pollution, accounting for nearly 18% of all deaths that year. Of these, approximately 0.98 million were attributed to ambient particulate matter, while about 0.61 million were linked to household air pollution. Despite the magnitude of the problem, many residents find it difficult to grasp the reality of pollution in their daily lives. It is often discussed in headlines and winter health alerts, but rarely presented in a way that resonates with the experiences of local communities. With only a handful of government monitoring stations representing millions of people, individuals may feel the impact of smog without fully understanding the data behind it or understanding how prolonged exposure affects their health and livelihoods.

Patna has lived with this reality for years. In 2024, the city ranked 35th among the world's 50 most polluted cities, according to IQAir [2]. The annual average concentration of PM_{2.5} was 73.7 µg/m³, which is nearly ten times higher than the safety limit set by the World Health Organization.

The air quality challenge in Patna is also a regional issue. The geography of the Indo-Gangetic Plains traps pollution close to the ground, particularly during the post-monsoon season, due to stagnant meteorological conditions and higher air pollution emissions. Contributing factors include construction dust, brick kilns, traffic congestion, industrial activities, and other anthropogenic activities. Despite the presence of reference-grade monitoring stations, the geographic reach of official data still leaves gaps at the local level.

It was within this context that the 'Hyperlocal Mapping of Air Pollution and GHG Emissions in



A low-cost air quality monitoring sensor installed in a residential area in Patna

Patna' project was conducted during 2023–25. This initiative, a collaboration between Development Alternatives (DA), UNDP India, and the Bihar State Pollution Control Board (BSPCB), aimed to create a hyperlocal dataset on key pollution sources and gain insights into emissions at the neighbourhood level.

The DA team worked to deploy a network of **low-cost air quality monitoring sensors**¹ across representative areas of the city. They identified locations that accurately reflected population exposure and built local capacity to operate and maintain the devices. A **citizen science**² approach formed a core component of this effort; trained volunteers assisted in data collection using low-cost monitoring tools. Through structured training sessions and demonstrations, residents learned to monitor real-time pollution levels, log observations, and interpret emerging trends. By generating granular, community-led data, the initiative provided additional insights alongside official efforts, helping residents better understand local air quality patterns.

¹ A **low-cost air pollution sensor** is a device that uses one or more sensors and other components to detect, monitor, and report on specific air pollutants like particulate matter (PM) or carbon dioxide, and/or environmental factors such as temperature and humidity.

² Citizen science is the practice of public participation and collaboration in scientific research to increase scientific knowledge. Through citizen science, people share and contribute to data monitoring and collection programmes.



Sabhyata checking the sensor reading on her phone during a field walk

A Day in the Field – A Citizen Scientist’s Story

Among the many volunteers who joined the initiative was 25-year-old Sabhyata from Kankarbagh. She had long experienced the effects of poor air quality, especially during the winter months, but like most residents, she was unaware of the data behind those experiences. When she learned about an initiative that equips city residents with tools to monitor and understand local air quality, she decided to sign up for training, despite being unsure of what it would entail. During the training, she (and other volunteers) learned how to operate the low-cost sensors, read real-time air quality levels on a mobile app, and link pollution spikes to nearby activities. The system proved user-friendly, and soon monitoring air quality became part of her daily routine.

Every morning, she checked the day’s air quality reading before leaving home, carrying a portable sensor in her bag to track changes along her route. As she passed through congested traffic junctions and areas where waste was being burned, the pollution levels typically rose. In the afternoon, construction dust along her commute often caused the numbers to increase further. However, an evening walk in a quiet park would help reduce those levels again. These simple changes allowed her to see how dramatically pollution levels varied over short distances.

Over time, carrying the sensor helped her develop a clearer sense of the city’s air patterns. She began to notice which sections of her commute consistently recorded higher

readings, which neighbourhoods experienced late-evening increases linked to nearby brick kiln activity, and which areas remained relatively stable through the day. The data displayed on her screen provided a straightforward method to understand variations she had sensed but never been able to quantify.

As her routine became noticeable to others, her family, neighbours, and friends grew curious about the small device she always carried. Some wondered why pollution levels seemed to rise after dusk, while others asked for clarification on what the numbers really meant. These questions often continued into her classroom, where, as an environmental sciences student, she discussed the readings with her peers and explained the factors driving them. She noticed that having access to real data encouraged more thoughtful conversations. People began to ask informed questions about the air around them, and her training helped her explain the numbers in a way that made sense to those around her.

Not one story, but many

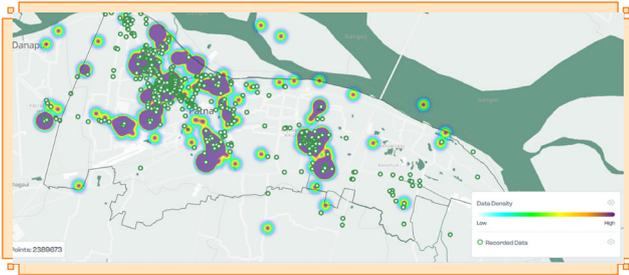
Sabhyata is one of 21 trained citizen scientists who participated in a project across Patna. Each volunteer contributed a unique perspective from their own neighbourhood. Some carried sensors during their daily commutes, while others monitored air quality near office complexes, markets, or construction sites. Together, they mapped areas of the city that had never been measured before.

Their observations, shared with the BSPCB and now accessible on a public dashboard, have provided clearer insights into local pollution patterns. The data shows consistent increases in pollution levels near traffic chokepoints, areas undergoing construction or demolition, and densely used public spaces.

Democratising Environmental Data

Beyond the numbers, the project reflects a transformative shift. It shows how data can become a shared tool for citizens. Involving communities in environmental monitoring strengthens a sense of local ownership of the clean air agenda.

For the citizen scientists, the experience went beyond a simple technical exercise. Many described it as empowering, as it validated their



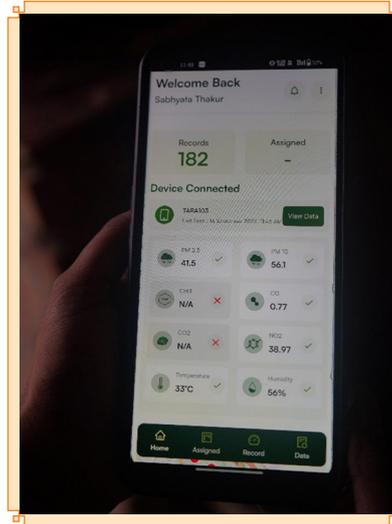
The VAYU by UNDP dashboard, showing data collected by the citizen scientists in Patna

observations and gave them a voice in discussions that often feel distant and technical. For Sabhyata and many others, the growing network of volunteers is reassuring. They are now asking new questions. They are reading the numbers. They are participating in the story of the air they breathe.

Clean air will require policy, planning, and long-term action. But this initiative has shown that progress can also begin at the local level. When residents monitor their own environment, they raise awareness and accountability. This makes pollution harder to ignore and helps shape the path toward cleaner, healthier cities. ☐

References

State-Level Disease Burden Initiative Air Pollution Collaborators. 2020. "Health and Economic Impact of Air Pollution in the States of India: The Global Burden of Disease Study 2019." *The Lancet Planetary Health* 5 (1): e25. [https://doi.org/10.1016/S2542-5196\(20\)30298-9](https://doi.org/10.1016/S2542-5196(20)30298-9)
 IQAir. "World's Most Polluted Cities." <https://www.iqair.com/in-en/world-most-polluted-cities>



The citizen scientist uses the VAYU app to log air quality measurements during a field walk



Felicitation ceremony of citizen scientists by officials from Bihar State Pollution Board and Development Alternatives

Test, Analysis, Build:

A Hands-on Workshop on Material Analysis

Date: 8th January 2026

Time: 2 pm to 5pm

Mode: Offline

(B-32, Tara Crescent, Qutub
Institutional Area New Delhi -
110 016, India)

Fee: 1500 Rs



WHAT YOU WILL LEARN

- Introduction to Material Testing & Standards
- Guided Visit to the Material Testing Lab
- Sustainable Alternatives in Construction

Scan to Register



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